A STUDY ON THE COOPERATIVE PLAN OF WATER RESOURCES FIELD BETWEEN SOUTH KOREA AND NORTH KOREA

By

JIN, Seong Won

CAPSTONE PROJECT

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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Committee in charge:

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ABSTRACT

A Study on the cooperative plan of water resources field between South Korea and North Korea

By

Seong Won Jin

This research paper aims to prepare a cooperation plan in water resources field between South and North Korea. In other words, this study has a meaning as a policy preparation phase to make a cooperative plan of water resources field in advance. Through this research paper, I assessed the current status of water resources in North Korea. Then, I would try to identify the problems of North Korea's water resources field through the literature review, document analysis, and strategic analysis by using tools. In addition, I investigated cases of cooperation not only domestic cases in Korea but also foreign countries cases.

Eventually, the most important thing in this research is that this paper suggests a cooperative plan of water resources field based on the questionnaire survey and its analysis. The questionnaire survey would conduct an actual survey to apply the judgment sampling method for the expert group and the general public group.

Finally, the purpose of this study is not to concentrate on the short-term perspective of water resources cooperation. Instead, the research is primarily focused on suggesting mechanisms for water resources cooperation in the long-term perspective that can sustainably alleviate the disparity in water resources between the two countries.

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1. Introduction

Having been separation for about 70 years, water resources field in South and North Korea has developed different perspectives and objectives regarding water resources utilization and has had different purposes of investment about the social infrastructures. In the case of South Korea, water resources policies were focused on preventing natural disasters such as floods and droughts as well as becoming the basis of economic development. On the other hand, North Korea's water resources policies seemed to be concentrated in maintaining their influence on the people by controlling electric power, food production, and military factories. Because of these, North Korea is suffering from repeated floods and droughts every year more than South Korea. In 2003~2012 alone, a massive flood affected 1,336 people died and cost the country 374 billion won worth of damages in North Korea (K-water, 2016).

Even though there is a tense situation between the two Koreas due to the North's nuclear missile problem, hope for reconciliation has sparked after the PyeongChang Winter Olympics and the inter-Korean summits held in 2018. Therefore, the subject of this research paper is significantly important to prepare a plan for cooperation in water resources field between two countries for the development of both nations and safety of the Korean people. Moreover, this research paper has some important implications as a policy preparation phase in advance to make a cooperative plan of water resources field in the process toward unification. In other words, although it is difficult to forecast that unification may take place whether a short period of time or long period of time, the topic of this research paper is a significantly important issue which is seeking various ways of cooperation in water resources field between two countries. There is no doubt that it is the best way to thoroughly prepare the plan in advance rather than causing confusion with the absence of a plan at the time it is needed.

A previous research conducted by the Ministry of Land, Infrastructure, and Transport

(2016) has shown the overall water resources conditions in terms of policies, the total amount of water resources, the condition of water resources facilities and water quality in South Korea. Meanwhile, according to a study on inheriting unification policy for Korean community, it suggested the principles in terms of the necessity of institutional strategy, the opinions for improving implementation and organizational structure (Kim et al., 2016). In 2008, Y.B., Kim has proposed a gradual approach to shared rivers management and water supply projects between South and North Korea. Furthermore, H.S., Kim (2018) emphasized that it needs to the gradual approach to improve performances of the plan in terms of water resources cooperation. Meanwhile, according to the survey on water resources management system and utilization in North Korea conducted by K-water (2016), it has focused on a survey about water resources management system and utilization such as precipitation, topography and the total amount of water resources in North Korea. In addition, a prospect on a dam project in the Korean peninsula considering its unification, this research briefly described the status of water resources and dam facilities in North Korea (Park et al., 2007).

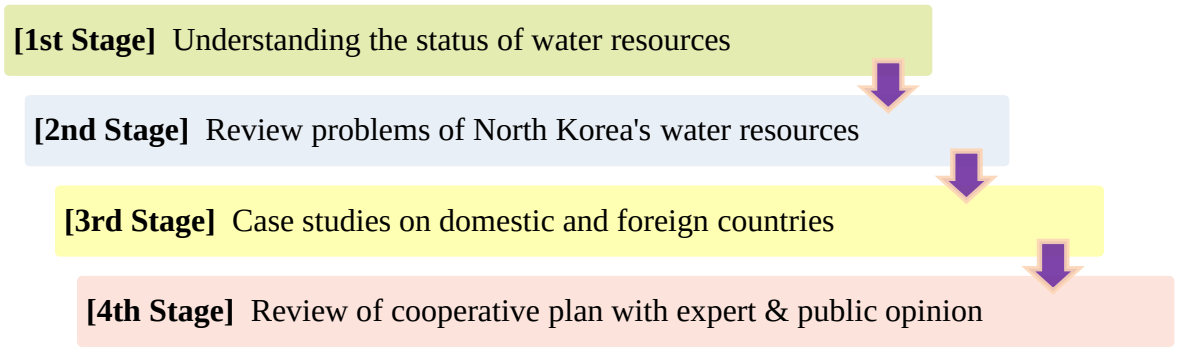
However, most of the previous researches have not considered the opinion of experts and the general public in dealing with a cooperative plan for water resources field between two countries. This research paper will approach this issue differently by generating the perspectives of experts and the general public through a questionnaire which will be applied with judgment sampling of non-random sample method. This study will be of interest to policymakers, government officers in the water resources field and the other fields which are necessary to cooperate with North Korea.

The purpose of this paper is to prepare a practical cooperation plan in the water resources field. For this purpose, this paper will increase the practicality of the plan together with the unification policy of the Korean government. This paper seeks to maximize the efficiency by suggesting realistic and feasible business projects at each stage for unification.

At the same time, this paper will also highlight that what is needed the most in North Korea's water resources field and how we should establish the cooperation system and plan with North Korea based on South Korea's experiences and technical expertise. In addition, through this research paper, I aim to shed light on a compared and re-arranged data in water resources field between two countries and identify the experts and general public opinions in terms of water resources cooperation with North Korea.

Ultimately, this study will attempt to answer the following research questions: First, what are the problems of North Korea's water resources field through investigation of water resources management and system as well as the condition of its water resources utilization compared to South Korea? Second, what are the case studies in domestic and foreign countries for water resources cooperation? Lastly, how should we establish the cooperative plan of water resources field between South and North Korea? This research paper is divided into four steps in order to establish a method for cooperating in the water resources field between two countries. First, I analyze the current status of water resources in order to understand the water resources of South and North Korea. Then, I identify the problems of North Korea's water resources field. As a third step, I investigate cases of cooperation not only domestic cases in Korea but also other countries cases. Finally, this paper suggests a cooperative plan of water resources field based on the questionnaire survey and its analysis. Having provided a context for this research paper, I will now proceed to review the secondary literature on water resources cooperation with North Korea and government unification policy.

Figure 1 Procedure of the study.



2. Literature review

In the section, I will provide an account of the development of scholarship in the field of water resources cooperation between South and North Korea. Literature on the water resources cooperation between the two countries has been largely divided into three sections. The first is a proposal that the situation of water resources in North Korea has been investigated and a more detailed cooperation plan should be established for the future (Lee, 2012; Lee et al., 2008). The second is to examine the problems of the shared rivers and to suggest alternatives through various theoretical frameworks (Jung, 2014; Lee, 2011; Kim, 2008; Choi et al., 2008). In particular, the issues on the shared river have been actively discussed by many scholars because Korea is currently faced with the problem. The third is a study that suggests step by step process on various aspects of water resources cooperation (Kim, 2018; K-water, 2016; Kim, 2008).

However, research on water resources cooperation between the two countries was relatively few compared to the number of studies on shared rivers. In addition, there is a limit to the credibility of the research results due to limited information and lack of data about the condition of North Korea’s water resources (K-water, 2016). Therefore, acquisition of accurate information on the condition of North Korea’s water resources is an important research task as well as it is significantly important components to get the precise information not only in preparing water resources cooperation plans in the present but also in crafting

more detailed cooperation plans in the future. Meanwhile, the unification policy of the government was the subject of significant academic research and it has received much attention from scholars (Koh, 2014; Choi, 2013; Kwon, 2009). Especially, Kim (2016) points out that the relation between unification policy and water resources cooperation. He asserts that research on water resources cooperation would be needed to become the same direction in accordance with the policies of the government unification. This point of view seems reasonable to emphasize practicability of the policy in water resources cooperation. Next, I will consider the contemporary context and debate in the field of water resources cooperation between two countries.

This research paper agrees with the claim that water resources cooperation between two countries should be pursued a step by step process and gradual approach. Kim (2018) makes a valid point about the need for a gradual approach to shared rivers management and water supply projects based on the assessment of North Korea's water resources capacity in terms of energy, water disaster response, and water supply. Similarly, although Kim (2008) does not cover the problem of water resources cooperation between two countries, he adopts the same approach and suggests a step by step implementation plan and detailed directions in solving the problems of the shared river, which is one part of the water resource cooperation plan. I also take a similar position on the gradual approach of Kim (2018, 2008). In particular, according to the survey on water resources management system and utilization in North Korea conducted by K-water (2016), it provides obvious and more viable water resources cooperation plan. This research paper takes the same stances as the Korean government's unification plan on the major tasks of water resources cooperation and suggests a step by step approach to water resources cooperation in a relatively large framework. This has some important implications for the way the policymakers conduct water resources cooperation policy with North Korea.

Before proceeding further, it is necessary to define clearly the key terminologies referred to in this research paper. At the outset, it is imperative to clarify what we mean when we talk about “water resources”, “water resources cooperation”, and “Unification plan”. According to K-water which is responsible for water as a public corporation in South Korea, water resources are water that can be used as a resource by human beings in the natural existing (2018). In addition, water resources cooperation is defined as sustainable development in order to promote common interests and consider the future in terms of water and land use (K-water, 2016). Meanwhile, according to the Ministry of Unification (MOU), the unification plan can be defined as the unification policy for the Korean community and it is planning to promote the unification in three stages. The unification plan of the South Korean government is aiming at a gradual unification plan in tandem with the development speed and both countries relations. 1) Reconciliation and cooperation stage, 2) South and North confederation stage, and 3) Unification stage. It can be understood as the intention to maximize the efficiency on the process of absorbing shock and burden (2017). In order to achieve the purpose of this paper, having discussed water resources cooperation and government unification plan, let us now turn to a discussion on the limitations and boundaries of this study.

The purpose of this study is not to concentrate on the short-term perspective of water resources cooperation. Instead, the research is primarily focused on suggesting mechanisms for water resources cooperation in the long-term[1] perspective that can sustainably alleviate the disparity in water resources between the two countries. In addition, I will conduct an actual survey to apply with the judgment sampling of non-random sample method for experts in the water resources and the general public. Based on the results, I intend to draw up a water resources cooperation plan in the same context as the government's unification plan. In other words, this study attempts to compare with the opinions of experts and general public

1. There is no clear standard, but the national long-term plan is established every 20 years.

mutually on the necessity of water resources cooperation at the present. This could provide a way to water resources cooperation on the basis of each opinion. At the same time, it is possible to draw up a plan for water resources cooperation based on a combination of the two opinions. Therefore, it could be a useful research case in order to reduce the differences between experts and the general public viewpoint. In more concrete terms, it will be able to understand the general public's viewpoint in terms of water resources cooperation and contribute to the useful study that can secure the support of the general public with government policy at the same time. Ultimately, most of the previous research does not fully address the experts and general public opinions to contemplate the issue of water resources cooperation. Thus, this study will be able to discuss with various opinions in terms of the water resources cooperation between the two countries.

It seems appropriate to limit the present study because there is a limit to expanding the study to the detailed plan of each project. In other words, it is not within the scope of this study to consider the detailed implementation plan of each project which should be reviewed together with the relevant laws and systems because it is difficult to obtain reliable results considering the uncertain environment. Instead, it could be possible to see a big picture of the overall water resources cooperation between two countries.

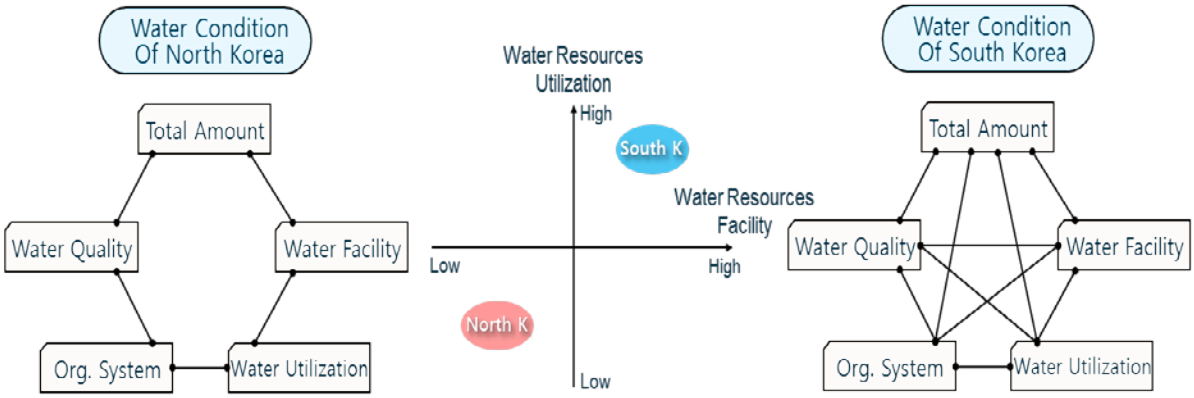
3. Document analysis and Case studies

3.1. Document analysis

It is similar to rainfall and topography condition between two countries, but North Korea which does not have large-scale water facilities such as multi-purpose dams is relatively poor compared with South Korea in terms of water infrastructure. In particular, North Korea also has a low water resource utilization rate due to the lack of water resources facilities and most of the rivers water quality is inadequate to use as drinking water due to the lack of sewage

treatment facilities.

Figure 2 Water condition between the two countries.



*(Source) This figure comes from this paper

3.1.1 Condition of rainfall and topography

As a typical Korean peninsula, it is similar forms that eastern parts are mountain area and western parts are the plain area. While South Korea is divided into five rivers, North Korea has seven rivers[2]. In addition, the average annual precipitation of South Koreas is 1.4 times higher than North Korea. The average annual precipitation in South Korea is almost 1,300mm especially the south coast and Gangneung is heavy rainfall area. Meanwhile, the annual average precipitation in North Korea is 920mm, the Wonsan-bay and Cheongchun river area were representative heavy rainfall area.

Table 1 Comparison of water resources status.

Item	South Korea	North Korea	Note
Rainfall Topography	1,300mm, 65% Mountain area (Concentrated flood season)	920mm, 80% Mountain area (Concentrated flood season)	
Amount of water resources	132billion ㎥/yr (Use 28%)	128billion ㎥/yr (Use 8%)	(South) 37billion ㎥/yr (North) 10billion ㎥/yr
Source of supply for use	River 9% (12billion) Reservoir 16% (21billion) Groundwater 3% (4billion)	River 5% (6billion) Reservoir 2.5% (3billion) Groundwater 0.5%(1billion)	

2. Amnok, Dooman, Daedong, Cheongchun, Imjin, Bukhan, Yesung river

*(Source) Water vision 2020, Survey on water resources management system and utilization in North Korea

3.1.2 Condition of water resources

Although the total amount of water was not much difference between the two countries, South Korea has about 132 billion cubic meters per year while North Korea has 128 billion cubic meters per year. However, it shows a considerable difference in terms of water utilization rate. While South Korea uses 37 billion cubic meters of water which is about 28% of total annual water resources, North Korea uses 10 billion cubic meters of water which is only 8% of total annual water resources.

To be in detail, water utilization rate from the river is 9% in South Korea and 5% in North Korea. The reservoir supply rate is 16% in South Korea and 2.5% in North Korea. In addition, groundwater use rate is 3% in South Korea and 0.5% in North Korea. As a result, the lack of water facilities such as a multi-purpose dam, intake and pumping station from the river is significantly impoverishing the water utilization rate of North Korea.

3.1.3 Condition of water resources facilities

South Korea has 23 billion cubic meters of storage capacity in about 18,000 water resources facilities including multi-purpose dam, water supply dam, agricultural reservoir and it is possible to supply up to 21 billion cubic meters per year. On the other hand, available information provided by the International Commission on Large Dams (ICOLD, 2007) and the Korean Society of Civil Engineers (KSCE, 1997) put the number of water facilities in North Korea at only about 70, which includes 25 irrigation dams, 5 power generating dams, 23 multi-purpose dams and others.

Table 2 Comparison of water resources facilities.

Item	South Korea	North Korea

Total Sum	17,524 places (Supply 21billion ㎥/yr)	1) International dam registration(ICOID), about 70 places(Multi-purpose 23, irrigation 25, hydroelectric 5, others for water supply) * A prospect on a dam project in the Korean peninsula considering its unification (Park et al., 2007)
Multi-purpose dam	21 places (Supply 11billion ㎥/yr)	
Water supply dam	54 places (Supply 1billion ㎥/yr)	2) 5 places estuary and dam in Daedong river basin, 21 places hydroelectric dams, 70 places dams, 21 places irrigation dams * Trend of development and water resources condition (Jun et al., 1997) 3)70 places dam list * A study on the development of water supply system in North Korea (MOE, 2013) ※(ICOLD) International Commission on Large Dam
Hydroelectric dam	15 places (Supply 1.3billion ㎥/yr)	
Irrigation dam	17,401 places (Supply 4billion ㎥/yr)	
Estuary Freshwater lake	12 places (Supply 3billion ㎥/yr)	
Barrage	16 places (Supply 0.7billion ㎥/yr)	

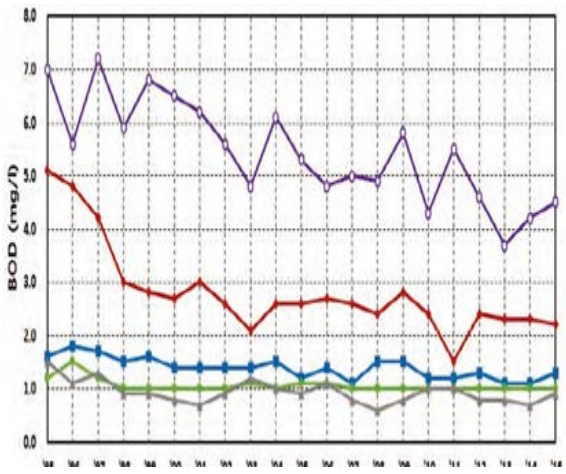
*(Source) Water vision 2020, Study on the development of a water supply system in North Korea, ICOLD etc.

3.1.4 Condition of water quality

In the case of South Korea, according to Water Vision 2020 and water environment information system by the Ministry of Unification (MOE), there are maintaining “good water achievement standards” in the 4 rivers except the Young-san River. No specific data is available for North Korea, but according to a study on the development of a water supply system in North Korea, water quality is not suitable to use as drinking water. The Dooman River, in particular, was reported to have a serious water pollution.

Table 3 Comparison of water quality.

South Korea	**North Korea**

 (Blue) Han, (Red) Nak-dong, (Green) Geum (Purple) Young-san, (Grey) Sum-jin river	(Daedong) Sight of fish dying, Residents stomachache Inflow the wastewater and human waste (Cheongchun) Unrecoverable river, Inflow the factory wastewater and livestock wastewater (Dooman) Serious water pollution, Mine wastewater Inflow the Musan mine and Hoeryeong paper manufactory's wastewater (Amnok) Not suitable for drinking water, Inflow industrial sewage and dishwater (Neighboring coast) Industrial sewage, Marine pollution

*(Source) Water vision 2020, water environment information system, Study on the development of a water supply
system in North Korea etc.

3.1.5 Water management organization system

South Korea's water management has been carried out by the law. Especially, water-related laws like the River Act and the Water Supply and Water Works Installation Act were established in the 1960s. North Korea's water-related laws, on the other hand, were only established in the 2000s. Their water management system is similar to South Korea's dual system[3] which operated and managed by the central and local governments. But in reality, it seems to be controlled by the Labor Party of North Korea.

3.2. The problems of North Korea's water resources management

The major problem of water resources in North Korea is not only the lack of investment in water resources facilities due to deficient finances but also the aging of existing facilities and lack of technology. For these reasons, there

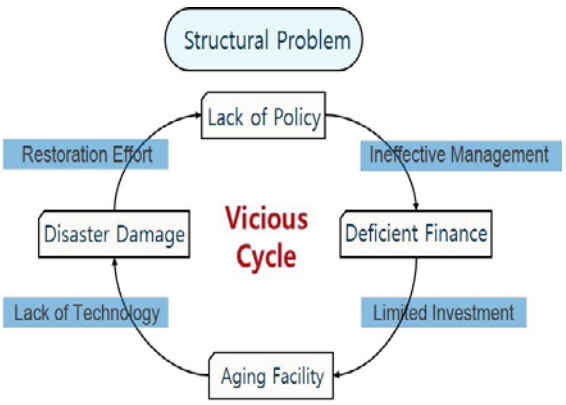


Figure 3. Structural problems in North Korea.
*(Source) This figure comes from this paper

3. National stream managed by central government, local streams managed by local governments.

is a vicious cycle of structure constantly occurring natural disaster such as floods and droughts every year.

3.2.1 Every year repeated flood damages

According to the water infrastructure plan of North Korea and news reports, 1,336 people died and 374 billion won worth of damages resulted from the floodings that occurred between 2003 and 2012. In August 2007 alone, 600 people were killed and 339 billion won worth of damages were recorded due to heavy rainfall. When typhoon “Goni” hit the country in August 2016, 40 people died and 11,000 people were affected. 138 people were killed and 400 people were missing due to floods in September 2016. It is a current reality of North Korea that occur flood damages in underdeveloped country type every year.

3.2.2 Periodic draught damages

According to water infrastructure plan of North Korea and media reports, there was severe drought which was only 11% rainfall compared with normal year during about 100 days from March 2001 to June 2001. About 90% of major cultivated areas such as Pyongyang, Pyongan, and Hwanghae provinces had suffered from drought from April to June 2012. In addition, 40~50% of winter and spring crops were reduced due to 100 years frequency drought in 2015.

Table 4 Damage of flood and drought in North Korea.

Flood damages	**Drought damages**
Death 138 persons, absconder 400 persons(Sep ’16)	Rainfall about 10% compared with normal year
Death 40 persons, victims 11,000 persons(Aug ’15)	during 100 days(’01)
Death 600 persons, cost KRW 339 billion(Aug ’07)	From April to June, entire area drought damage (’12)
Death 1,336 persons, cost KRW 374 billion(’03~’12)	100 years frequency drought(’15)

*(Source) Study on the development of a water supply system in North Korea, Yonhap, KBS

3.2.3 Decreased reliability of data and actual use of water

The published data are different from reality and it was raised a question about reliability even public data which were submitted to international organizations by North Korea's government because of artificial revision. In interviews with North Korean defectors, there are many testimonies that "The existing waterworks facilities are being used to build new immigration complexes and data submitted to international organizations is handled by the labor party."

In terms of water use, the vicious cycle of natural disaster damages is constantly occurred due to the aging of facilities and the lack of technology. In the case of energy, most of the facilities are degraded due to the deterioration. Electricity production which is North Korea's main policies has been declining dramatically and its irrigation facilities have been scarce as well as the existing irrigation system has suffered due to deterioration of the power supplies.

As a result, the supply of agricultural water has been insufficient. Water supply system and wastewater facilities are also dependent on wells and groundwater due to the aging and the lack of technology. In the case of Pyongyang, the water supply rate is at 50% but the water supply system has been paralyzed along with economic deterioration. The river is seriously polluted by industrial wastewater, domestic sewage and is adversely affecting drinking water quality as it infiltrates groundwater.

3.2.4 Strategic analysis results

In the case of using strategic analysis tools on the issue of water resources in North Korea, the following results were obtained. Figure 4-5 present the results of the SWOT analysis, advanced SWOT analysis, PESTEL analysis, and 7S-MODEL.

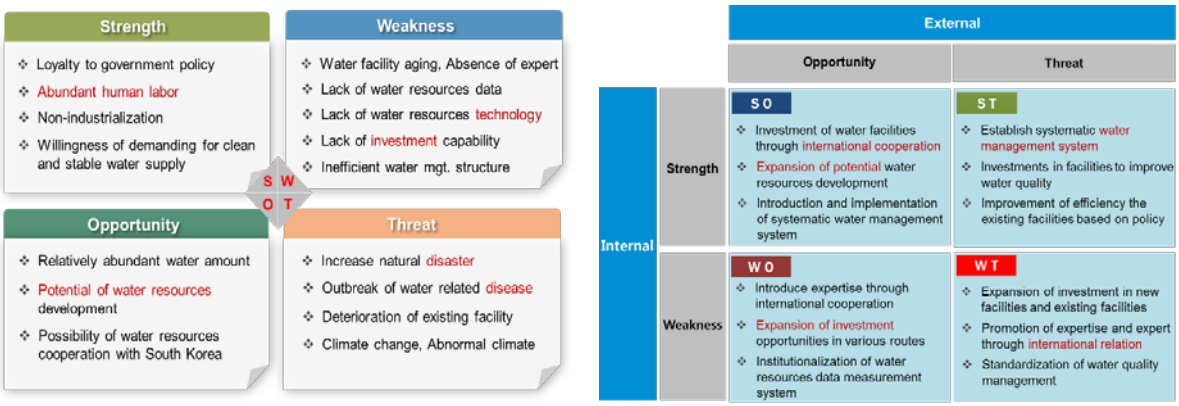
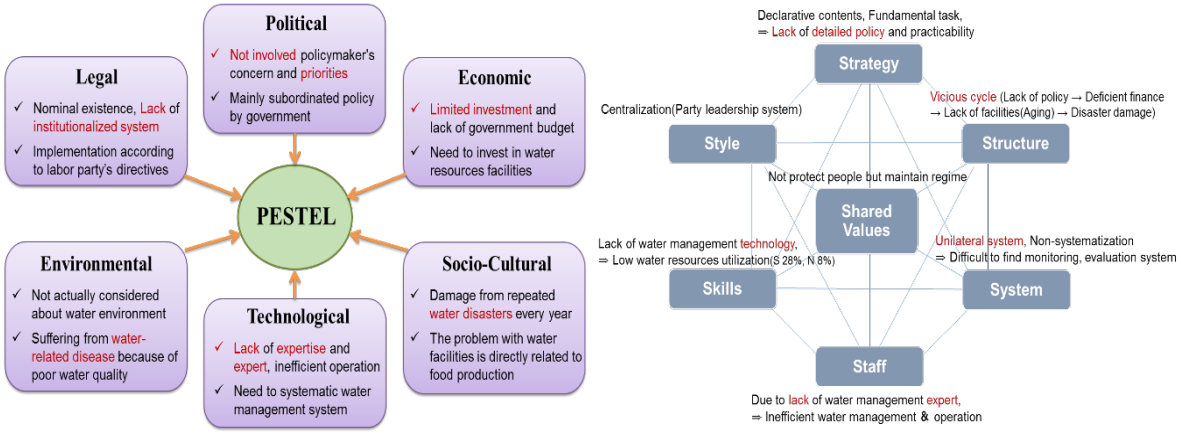


Figure 4 The results of SWOT and advanced SWOT analysis.

Figure 5 The results of PESTEL analysis and 7S-MODEL.



*(Source) Figure 4-5 come from this paper

3.3. Case studies in domestic and foreign countries

Through the case studies on water resources cooperation both domestic and foreign country cases, it will find important elements that can be cooperated and use it as a best practice. In the meantime, various factors have complicatedly influenced the cooperation of water resources. In addition, it was normally operated that if they have the same social systems or a minimal number of mutual disputes. However, it had difficulty implementing the cooperation plans that if they have competition or conflict relations about interests.

3.3.1 Domestic cooperation cases

According to the political and security

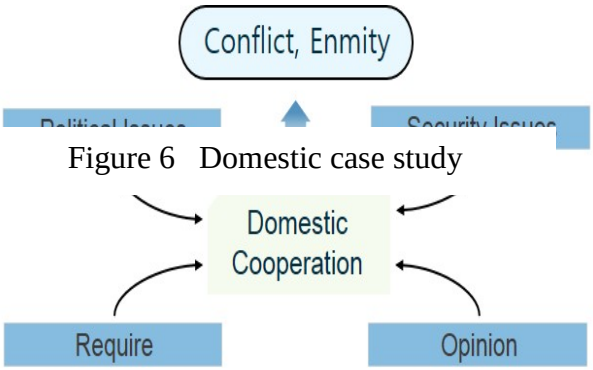


Figure 6 Domestic case study

*(Source) This figure come from this paper

situation, between South and North Korea have been a structure which is repeated cooperation and confrontation. Representative best practice is water resources facilities construction and operation for supplying the water in the Kaesong Industrial Complex. By utilizing the Wolgo Reservoir, this facility supplied 45,000 cubic meters water per day to the Industrial Complex and 15,000 cubic meters water per day to Kaesong City until it was shut down in 2016.

Table 5 Cases of domestic cooperation.

Item	Cases of cooperation	Results of cooperation
South Korea and North Korea	Imjin river flood prevention discussion	Passive, break in the discussion
	Imnam dam joint investigation discussion	Require compensation, discussion later
	Water supply facility construction agreement in the Kaesong industrial complex	Suspension of the water supply, political and national security problems

*(Source) Survey on water resources management system and utilization in North Korea

3.3.2 Foreign cooperation cases

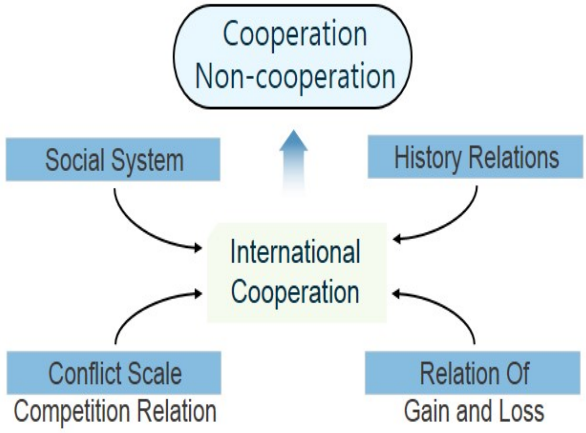


Figure 7 Foreign case study

*(Source) This figure comes from this paper

It has been shown that there is a tendency to repeat the disputes and cooperation based on the relation of gain and loss such as political situation and interests of their own countries. There are many cases of cooperation from around the world. Representative cases are the Rhine's cooperation in Western Europe and cooperation of the Great Lakes between the United States and Canada. In the case of the Rhine, countries such as Germany, France, Switzerland, and Netherland etc. cooperated to prevent natural disasters and preserve ecology on the Rhine.

Table 6 Cases of international water resources cooperation.

Item	Cases of cooperation	Results of cooperation
North Korea and Chine	Hydroelectric company establish in Amnok river	Normal operation
East Germany and West Germany	Agreement of water resources cooperation between two governments	Normal operation (Unification)
Eastern European Countries	Werra and Roden river cooperation Danube river cooperation	Werra river still discussion, Roden and Danube river normal operation
Western European Countries	Water quality control cooperation in Rhine river	Normal operation
USA and Canada	Cooperation of the Great Lakes	Normal operation
USA and Mexico	Agreement of water resources in Rio-Grande	Compromise of dispute
Middle East Asia Countries	Water conflict discussion of Jordan river	Political and religion problem, break in discussion
South East Asia Countries	Development of Mekong river discussion	Still discussion

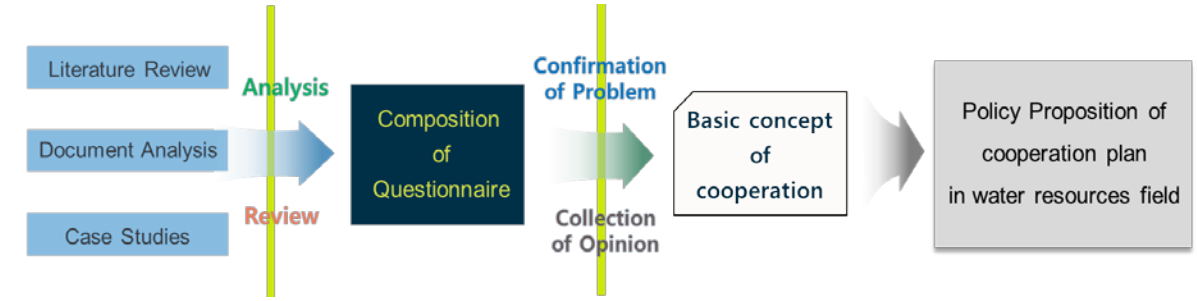
*(Source) Survey on water resources management system and utilization in North Korea

4. Questionnaire survey

4.1. Theoretical framework

The questionnaire was organized based on a literature review, document analysis and case studies reviewed above. Through the analysis of questionnaire results, this research was conducted on how to cooperate in the water resources field between South and North Korea. As mentioned in the literature review, there have been some research results on cooperation between two countries in the water resources field. However, there was difficulty finding the case that the questionnaire survey was conducted on the expert group and the general public group. The theoretical framework of the present study could be easily understood by visualizing it as shown in Figure 8.

Figure 8 Theoretical framework of research.



4.2. Sample design and statistical characteristics

Based on the theoretical framework mentioned above, samples to be investigated were selected considering the specificity of this research topic. In case of an expert group, it has at least 5 years of experience in major water-related fields such as water resources and water supply sector. Most of the survey respondents are considered to have worked for more than 10 years. On the other hand, the general public group was not engaged in water resources field, but as a resident of South Korea, they recognized general inter-Korean relations and evenly distributed considering their occupation, gender and age groups.

This sample design was based on the judgment sampling of non-random sample method which is a method of sample selection that are deemed to be the best representative of the population based on the subjective judgment of the researcher for this subject. In addition, the expert group was a total of 40 experts which were composed of 21 people working in the water resources sector and 19 people working in water supply sector. For the general public group, a total of 20 people (12 males and 8 females) were sampled for 10 people in non-worker and 10 people in the worker. The reason for the difference in sample number between expert and the general public groups should be in order to place more weight on the response of the expert group in consideration of the characteristics of this research topic.

Table 7 Characteristics of the survey group.

(Unit: persons)

Total	Expert group			General public group		
	Subtotal	Water resources	Water supply	Subtotal	Non-worker	Worker
60	40	21	19	20	10	10

4.3. Survey period and methodology

The survey was conducted from August 20, 2018, to September 25, 2018. In the case of the expert group, the total of 44 copies was distributed, and about 90% of the copies were collected. The general public group was able to collect 20 copies out of the total 21 copies. In addition, regarding the survey method, 20 copies of expert groups were conducted after the researcher directly explained the purpose and instruction of the survey by face-to-face, and the other 20 copies were an online survey which was conducted by K-water's internal network and E-mail to get the results. Moreover, for the general public group, all 20 copies were collected after the researcher directly explaining the purpose and instruction of the survey by face-to-face.

Table 8 Characteristics of the survey respondents.

(Unit: persons)

Item		Expert group	General public group
Gender	Male	33	12
	Female	7	8
Age	20's	1	5
	30's	18	6
	40's	20	4
Age	50's	1	3
	60's or more	-	2
Field	Administration (Economy)	5	7
	Planning (Strategy)	10	2
	Design (Policy)	2	-
	Business (Development)	8	3
	Operation & Management	15	8

4.4. Questionnaire contents and composition

4.4.1 Questionnaire contents

The main contents of the questionnaire were based on the literature review, document

analysis, case studies such as theses, research reports, and published journals on water resources cooperation between the two countries. At the same time, the questionnaire was concretely reviewed according to the purpose of the study and research questions. The questionnaire consisted of 26 questions in total, and main domains classified into three categories as follows.

1. Evaluation phase - The cooperation necessity between the two countries, the necessity for policy recommendations and the recognition of water resource condition in North Korea.
2. Implementation phase - Cooperation fields, basic principles, and areas of business, awareness of costs and benefits.
3. Monitoring phase - Technical field and organizational structures to be developed for cooperation and questions for statistical processing.

4.4.2 Questionnaire composition

First, the questions regarding the necessity of cooperation and the necessity of government policies in the evaluation phase were measured based on the 5-point Likert Scale. The questions about implementation and monitoring phase consisted of the method for item selection or multiple choice by respondents.

Table 9 Composition of the questionnaire.

Domain	Sub-Domain	Operational Definition	Evaluation method
Evaluation	Necessity of cooperation	The necessity of water resources cooperation between South and North Korea	Likert Scale
		Need to suggest the government policy in the water resources field between South and North Korea	
	North Korea Water Resources Status	Compared with South Korea, the awareness of the status of water resources in North Korea	Select item
		Vulnerable causes in North Korea's water resources	
Implementation	Cooperation fields	Fields that need urgent improvement for cooperation	Select item
		Priority should be placed on cooperation	

		High practicability Fields for collaboration	
		The target area for the pilot project	
	Cooperation principles And Business Areas	Appropriate examples of cooperation between South and North Korea	Select item (Some, multiple choice)
		Suitable models among overseas cooperation cases	
		Basic principles for cooperation in water resources field between South and North Korea	
		Short-term promotion projects for cooperation	
		Long-term promotion projects for cooperation	
		A desirable form as a promoter for cooperation	
	Costs and benefits	Measure to solve cost problems for cooperation	Select item (multiple choice)
		Benefits of South and North Korea through cooperation	
Monitoring	Technology	Required skills to develop for cooperation	Select item (multiple choice)
	Organization	Structure of organization for planning, implementation, and monitoring	Select item (multiple choice)
General Information	Gender	Gender of respondents	Select item
	Age	Age of respondents	
	Field	Field of respondents	

4.5. Analysis of survey results

4.5.1 Evaluation Phase

4.5.1.1 Necessity of cooperation

In terms of questions on the need for water resources cooperation between two countries, 56 out of the 60 respondents (93.3%) gave the answer that it is necessary. In particular, majority of the expert group members said that there is an extreme need for cooperation as they answered “completely true” in the question about the necessity of the cooperation. The general public group, on the other hand, was slightly conservative having answered “very true” in the scale.

Table 10 Necessity of cooperation in the water resources field.

(Unit: persons, %)

Item	Completely true	Very true	Moderately true	Not true	Absolutely not true
Total	36 60	20 33	4 7	- -	- -
Expert group	31 77.5	9 22.5	- -	- -	- -
General public group	5 25	11 55	4 20	- -	- -

In addition, in terms of questions on the need of policies suggestion for water resources cooperation between two countries, 53 out of the 59 respondents (89.9%) agreed that there is a need for policy suggestions on water resources cooperation. Similar to the first question, the expert group picked the more progressive option in the scale compared to the other group.

Table 11 Necessity of government policy for cooperation.

(Unit: persons, %)

Item	Completely true	Very true	Moderately true	Not true	Absolutely not true
Total	28 47	25 42	2 3	4 7	- -
Expert group	23 59	14 36	1 3	1 3	- -
General public group	5 25	11 55	1 5	3 15	- -

*(Note) 1 person in the expert group did not respond to the question.

4.5.1.2 Condition of water resources in North Korea

Out of the 59 respondents, 40 respondents (67.8%) perceived the level of water resources in North Korea to be at the same level as that of the condition in South Korea during the 1970s and 1980s. This period is characterized by the absence of a water resource management system and technology, coupled with the occurrence of natural disaster. Both the expert group and the general public group exhibited similar perceptions on this matter.

Table 12 Recognition of North Korea's water resources.

(Unit: persons, %)

Item	1950～1960′s	1970～1980′s	1980～1990′s	1990～2000′s	2000～present
Total	10 16.9	40 67.8	8 13.6	1 1.7	- -
Expert group	8 20.5	25 64.1	5 12.8	1 2.6	- -
General public group	2 10	15 75	3 15	- -	- -
Note	* 1950～1960s Level: Lack of facilities and systematization, poor facilities and technologies * 1970～1980s Level: Lack of systemization such as management and technologies * 1980～1990s Level: Water resources facilities and systemization are overall organized * 1990～2000s Level: Water resources facilities and systemization are highly organized * 2000～Present Level: Very systematic water management level similar to South Korea				

*(Note) 1 person in the expert group did not respond to the question.

Moreover, 39 out of the 59 respondents (66.1%) believed that the main causes of the ill-developed water resources fields of North Korea were due to the lack of financial resources and investments. This opinion was the same for both sample groups. Factors such as the lack of skilled manpower and technologies, water management systems and government policies were also noted by the respondents. This exhibits the vicious cycle of the poor water resource management structure earlier discussed in Chapter 3.

Table 13 North Korea's Water Resources.

(Unit: persons, %)

Item	Lack of financial resources & investments	Lack of skilled manpower & technologies	Water management organization problems	Water management system problems	The absence of water policies
Total	39 66.1	6 10.2	1 1.7	7 11.9	6 10.2
Expert group	27 69.2	5 12.8	- -	3 7.7	4 10.3

General public group	12 60	1 5	1 5	4 20	2 10

*(Note) 1 person in the expert group did not respond to the question.

4.5.2 Implementation phase

4.5.2.1 Cooperation fields

Out of the total 56 respondents, 20 respondents (35.7%) said that the most urgent aspect of cooperation is the prevention of natural disaster as floods and droughts. Unlike the expert group, the general public group responded that the cooperation on the shared river issue should be the first matter to be resolved. Therefore, the most urgent concerns that has to be addressed are the prevention of natural disasters and the problems on shared river.

Table 14 Urgent fields for cooperation.

(Unit: persons, %)

Item	**Prevention of natural disaster**	**Water supply businesses**	**Electricity problems**	**Shared river issues**	**Adaptation for climate change**
Total	20 35.7	8 14.3	5 8.9	18 32.1	5 8.9
Expert group	15 40.5	5 13.5	5 13.5	9 24.3	3 8.1
General public group	5 26.3	3 15.8	- -	9 47.4	2 10.5

*(Note) 3 respondents did not answer in expert group, 1 respondent did not answer in the general public group.

In addition, 28 out of 60 respondents (46.7%) said that the priority areas for cooperation have a high practicability or viability. Among the projects considered to be highly practicable, the areas of shared river management received support from half of the respondents. This suggests that even though natural disaster is an urgent concern, we need to solve the problem is the shared river issues first when considering reality we facing with and the probability of implementation aspect. Furthermore, having the Imjin River Basin as a pilot project garnered the highest response rate, implying consistency in the responses on the

preceding questions.

Table 15 Priorities for cooperation.

(Unit: persons, %)

Item	Fields related to residents′ life	High practicability fields	Fields of high project feasibility	Fields based on economic growth	Fields that can contribute to the unification
Total	13 21.7	28 46.7	2 3.3	14 23.3	3 5
Expert group	8 20	16 40	2 5	12 30	2 5
General public group	5 25	12 60	- -	2 10	1 5

Table 16 High practicability fields for cooperation.

(Unit: persons, %)

Item	Shared river management	Water supply to solve food problems	Technologies exchange for efficiency	Water quality management	Disaster prevention business
Total	30 50.8	9 15.3	11 18.6	3 5.1	6 10.2
Expert group	22 55	4 10	8 20	3 7.5	3 7.5
General public group	8 42.1	5 26.3	3 15.8	- -	3 15.8

Table 17 A pilot project region for Cooperation.

(Unit: persons, %)

Item	Gaeseong	Pyongyang	Imjin river	Bukhan river	Amnok river	Dooman river
Total	13 21.7	7 11.7	28 46.7	10 16.7	2 3.3	- -
Expert group	9 22.5	3 7.5	22 55	5 12.5	1 2.5	- -

General public group	4 20	4 20	6 30	5 25	1 5	- -

4.5.2.2 Cooperation principles and business fields

Prior to the question on cooperation principles and business fields, Part of the survey is a question on the respondents' preference on domestic and foreign cases of cooperation. In the case of domestic cooperation projects between South and North Korea, 29 out of 59 respondents (49.2%) said that the Kaesong Industrial Complex project is an appropriate model.

On the other hand, 66% answered that the Elbe River collaboration for improving the water quality between East and West Germany has a good framework among the cases involving foreign countries. The case of Germany's cooperation for shared rivers is in the same context as what Korea is facing now.

Table 18 An appropriate model among domestic cooperation cases.

(Unit: persons, %)

Item	**Mt. Kumgang Tourism**	**Gaeseong Industrial Complex**	**Cooperation of the shared river**	**Multinational development projects**	**no suitable way**
Total	3 5.1	29 49.2	9 15.3	6 10.2	12 20.3
Expert group	1 2.5	19 47.5	7 17.5	3 7.5	10 25
General public group	2 10.5	10 52.6	2 10.5	3 15.8	2 10.5

*(Note) 1 respondent from the expert group did not answer.

Table 19 A suitable case in foreign countries for cooperation.

(Unit: persons, %)

Item	Cooperation of water quality in Five Great Lakes (US-Canada)	Cooperation of water quality in the Rhine river (Western Europe)	Cooperation of water quality in the Elbe river (East-West Germany)	Cooperation of river use in Mekong river (Southeast Asia)	No suitable way
Total	5 8.5	4 6.8	39 66.1	8 13.6	3 5.1
Expert group	2 5	4 10	25 62.5	6 15	3 7.5
General public group	3 15.8	- -	14 73.7	2 10.5	- 1

*(Note) 1 respondent from the expert group did not answer.

On the question about the basic principles for cooperation between South and North Korea, 17 respondents (28.3%) answered that the basic principles should be mutually beneficial and highly feasible. In this question, responses were evenly distributed to the options given for this question. In particular, the preference difference between expert group and the general public group was shown. The expert group prefer that the basic principles should be based on promoting economic growth while 50% of the respondents in the general public group said that it should be secured the feasibility of the project.

Table 20 Fundamental Principles for Cooperation.

(Unit: persons, %)

Item	Basics for unification	Securing business feasibility	Priority to Urgent fields	Based on the economic growth	Based on the acceptability of North Korea
Total	9 15	17 28.3	10 16.7	13 21.7	11 18.3
Expert group	4 10	7 17.5	8 20	11 27.5	10 25
General public group	5 25	10 50	2 10	2 10	1 5

With regards to the necessity projects in short-term and long-term perspectives for cooperation, respondents were asked three multiple choice questions. For the short-term

projects, 24.2% picked conducting basic research projects that will identify the condition of water resources in North Korea. Some 19.1% of the respondents chose the disaster prevention projects while the remaining 16.9% went for the shared river management projects. Meanwhile, a quarter of the respondents chose the establishment of water resource cooperation plan among the options for the long-term projects. The hydroelectric power project had the support of 17.1% while the management of shared rivers got 16.6% of the respondents.

Results for the short-term projects are consistent with the results of previous questions that need to conduct the urgent and high practicability field first. This shows that the lack of reliable data on North Korea's water resources discussed in Chapter 3 must be addressed. In addition, the responses of the two sample groups on the issues of short-term and long-term projects have no significant differences.

Table 21 Short-term projects for cooperation.

(Unit: persons, %)

Item	Water supply business	Disaster prevention business	Power supply business	Water quality improvement project	Research projects for identifying the water resources condition	Mid & long-term plan	Shared river business	Expert and technology exchange
Total	13 7.3	34 19.1	14 7.9	19 10.7	43 24.2	12 6.7	30 16.9	13 7.3
Expert group	6 5.1	23 19.5	14 11.9	12 10.2	30 25.4	7 5.9	19 16.1	7 5.9
General public group	7 11.7	11 18.3	- -	7 11.7	13 21.7	5 8.3	11 18.3	6 10

*(Note) 1 respondent from expert group and 1 respondent from the general public group answered single choice.

Table 22 Long-term projects for cooperation.

(Unit: persons, %)

Item	Water supply business	Disaster prevention business	Power supply business	Water quality improvement project	Research projects for identifying the water resources condition	Mid & long-term plan	Shared river business	Expert and technology exchange
Total	14 8	21 12	30 17.1	13 7.4	11 6.3	43 24.6	29 16.6	14 8
Expert group	10 8.5	14 11.9	19 16.1	10 8.5	8 6.8	30 25.4	17 14.4	10 8.5
General public group	4 7	7 12.3	11 19.3	3 5.3	3 5.3	13 22.8	12 21.1	4 7

*(Note) 1 respondent from expert group and 1 respondent from the general public group answered single choice.

Finally, in terms of the question about the promoter of the project for cooperation, 42 out of 60 respondents (70%) said that the public sector including the government and public corporations should lead the cooperation while the private sector would be able to participate through the bidding process, etc. Considering the limitations set by the existing inter-Korean relations, it is a desirable direction to initiate the project by the public sector.

Table 23 Promoters of the project for cooperation.

(Unit: persons, %)

Item	Lead by the public sector, the private sector participate bidding process	Public sector arbitration, led by domestic private companies	Public sector arbitration, led by domestic and foreign private companies	Co-financing public and private sectors	Promote in various ways as needed
Total	42 70	1 1.7	1 1.7	8 13.3	8 13.3
Expert group	31 77.5	- -	- -	4 10	5 12.5
General public group	11 55	1 5	1 5	4 20	3 15

4.5.2.3 Cooperation costs and benefits

In the case of a survey on the cost problem for cooperation, we requested the two choices to the respondents. 37.7% of respondents answered that it is necessary to promote through exchanging South Korea's capital (Technology) and North Korea's resources (Labor force). Meanwhile, 34.2% respondents said that it could be possible to use the South-North Cooperation Fund at first and then make the plan through the consultation between two countries. This could be understood as a reasonable opinion that needs to pursue common benefits by utilizing mutually abundant resources rather than one-sided cost burden. Also, there were not many differences between the expert and general public group.

Table 24 Cost problems for cooperation.

(Unit: persons, %)

Item	Humanitarian Assistance	Exchange South Korea's capital and North Korea's resource	Using the South-North cooperation fund, Preparing a plan through consultation with North	Multi-national development project type (Attract foreign capital)	Based on international community support
Total	10 8.8	43 37.7	39 34.2	11 9.6	11 9.6
Expert group	10 12.7	30 38	26 32.9	5 6.3	8 10.1
General public group	- -	13 37.1	13 37.1	6 17.1	3 8.6

*(Note) 1 respondent from expert group and 5 respondents from the general public group answered single choice.

In the case of a survey on the benefits through cooperation between the two countries, we also requested the two choices to the respondents. A little over half (52.5%) of the respondents answered that benefit of North Korea would be able to solve problems that are related to economic growth such as the expansion of social infrastructures, and residents' life that faced with North Korea at present. In the case of South Korea, 27.1% responded that it

could be a basis for unification. At the same time, 26.3% answered that this would resolve the shared river issues.

Table 25 Benefits of North Korea through cooperation.

(Unit: persons, %)

Item	Economic growth	Solving the problem related to residents' life	Prevention of natural disaster damage	Technology improvement and efficiency	Solve power problems	Stable internal system
Total	27 22.9	35 29.7	23 19.5	14 11.9	18 15.3	1 8
Expert group	19 23.8	19 23.8	17 21.3	9 11.3	15 18.8	1 1.3
General public group	8 21.1	16 42.1	6 15.8	5 13.2	3 7.9	- -

*(Note) 2 people in general public group responded single choice.

Table 26 Benefits of South Korea through cooperation.

(Unit: persons, %)

Item	Basics for unification	Resolving the shared river issue	Improvement of economic efficiency	Reform and opening of North Korea	Attract foreign capital	Expansion of other businesses
Total	32 27.1	31 26.3	6 5.1	20 16.9	1 0.8	28 23.7
Expert group	20 25	20 25	2 2.5	13 16.3	1 1.3	24 30
General public group	12 31.6	11 28.9	4 10.5	7 18.4	- -	4 10.5

*(Note) 2 people in general public group responded single choice.

4.5.3 Monitoring phase

4.5.3.1 Technology and organization

The question of technology and organizational structure for cooperation required two answers to be chosen. Out of the total 118 respondents, 32.2% answered that technology for repairing and reinforcing of existing facilities such as aging dams is needed. Meanwhile, 25.4% said

that there should be attention to develop the low-cost and high-efficiency water management technology for improving water quality.

On the other hand, 42.5% of the respondents said that a new and unified organizational structure is needed while 22.1% said that a multilateral operation should be implemented. This means that the cooperation should seek the support and participation of the international community such as the United Nations and foreign experts. In addition, 21.2% responded that South and North Korea should operate as separate organizations. But if necessary, it could be possible to compose new organizations to handle the specific projects.

Table 27 Required technology for cooperation.

(Unit: persons, %)

Item	Repairing & reinforcing of existing facilities	Research & management technology based on 4th revolution	Low-cost & high-efficiency technology for water quality	Power generation facilities	Weather & hydrological prediction	Water facility connec-tion
Total	38 32.2	14 11.9	30 25.4	18 15.3	14 11.9	4 3.4
Expert group	26 32.5	7 8.8	20 25	10 12.5	14 17.5	3 3.8
General public group	12 31.6	7 18.4	10 26.3	8 21.1	- -	1 2.6

*(Note) 2 respondents from the general public group answered single choice.

Table 28 Organizational Structure for Cooperation.

(Unit: persons, %)

Item	Uniform new Organization	Separate organizations each nation	Separate organization by procedure & step	Separate organizations between public & private sector	Multilateral organization
Total	48 42.5	24 21.2	10 8.8	6 5.3	25 22.1
Expert group	36 46.8	16 20.8	8 10.4	2 2.6	15 19.5
General public group	12 33.2	8 22.2	2 5.6	4 11.1	10 27.8

*(Note) 3 respondents from expert group and 4 respondents from the general public group answered single

choice.

4.6. Evaluation of survey results

Through the questionnaire survey for water resources cooperation between South and North Korea, I collected opinions on the expert group and the general public group by dividing them into three aspects. Table 29 summarizes the survey results.

Table 29 Summary of survey results.

Domain	Sub-Domain	Operational Definition	Result of survey
Evaluation	Necessity of cooperation	The necessity of water resources cooperation	Very positive response
		Need to suggest the government policy	The very positive response about suggesting the government policy
	North Korea Water Resources Status	The status of water resources in North Korea	Recognized as the level of the 1970s～1980s in South Korea
		Vulnerable causes in North Korea's water resources	Insufficient financial resources and investments by the North Korean government
Implemen-tation	Cooperation fields	Fields that need urgent improvement for cooperation	Cooperation on disaster prevention business
		Priority	High practicability fields
		High practicability Fields for collaboration	Issues on shared river management
		The target area for pilot project	The Imjin river basin
	Cooperation principles And Business Areas	Appropriate examples of cooperation in domestic	Kaesong Industrial Complex Project
		Suitable models among overseas cooperation	Cooperation of water quality in the Elbe river (East-West Germany)
		Basic principles	Securing business feasibility
		Short-term promotion projects	Securing business feasibility, Disaster prevention business, Shared river business
		Long-term promotion projects	Mid & long-term planning, Power supply business, Shared river business

		A desirable form as a promoter	Lead by the public sector, the private sector participate bidding process
	Costs and benefits	Measure to solve cost problems	Exchange South Korea's capital and North Korea's resource, Using the inter-Korean cooperation fund, Preparing a plan through consultation with North
		Benefits of South and North Korea	(North Korea) Solving the problem related to residents′ life, Economic growth (South Korea) Basics for unification, Resolving the shared river issue
Monitoring	Technology	Required skills	Technology for repairing and reinforcing of existing facilities, Low-cost high-efficiency technology for water quality improvement
	Organization	Structure of organization	Uniform new Organization, Multilateral organization

5. Conclusion

In this research, I conducted an investigation in order to find out a big picture and desirable direction for cooperation between South and North Korea. Based on the results of the literature review, document and survey results analysis, this research concludes that it is possible to propose a water resources cooperation plan between North and South Korea according to the following criteria as shown in Figure 9 below.

First, the basic principles for cooperation should be promoted mutually beneficial and highly feasible projects between the two countries. Meanwhile, in order to take the same stances as South Korean government’s unification plan, a gradual approach from the small one to large scale rather than an instant implementation, must be employed. In terms of project prioritization, the projects that are highly practicable should be accomplished first, followed by the interventions that are closely related to the improvement of residents’ lives or

other urgent fields. Under the basic principles and priorities, the issues related to the shared river as a pilot project must be addressed first. In particular, the appropriate target area will be the Imjin river basin. In parallel with this, it is necessary to develop the technologies which are the repairing and reinforcing water resources facilities, low-cost & high-efficiency water management technologies and efficient technologies for small power generation facilities.

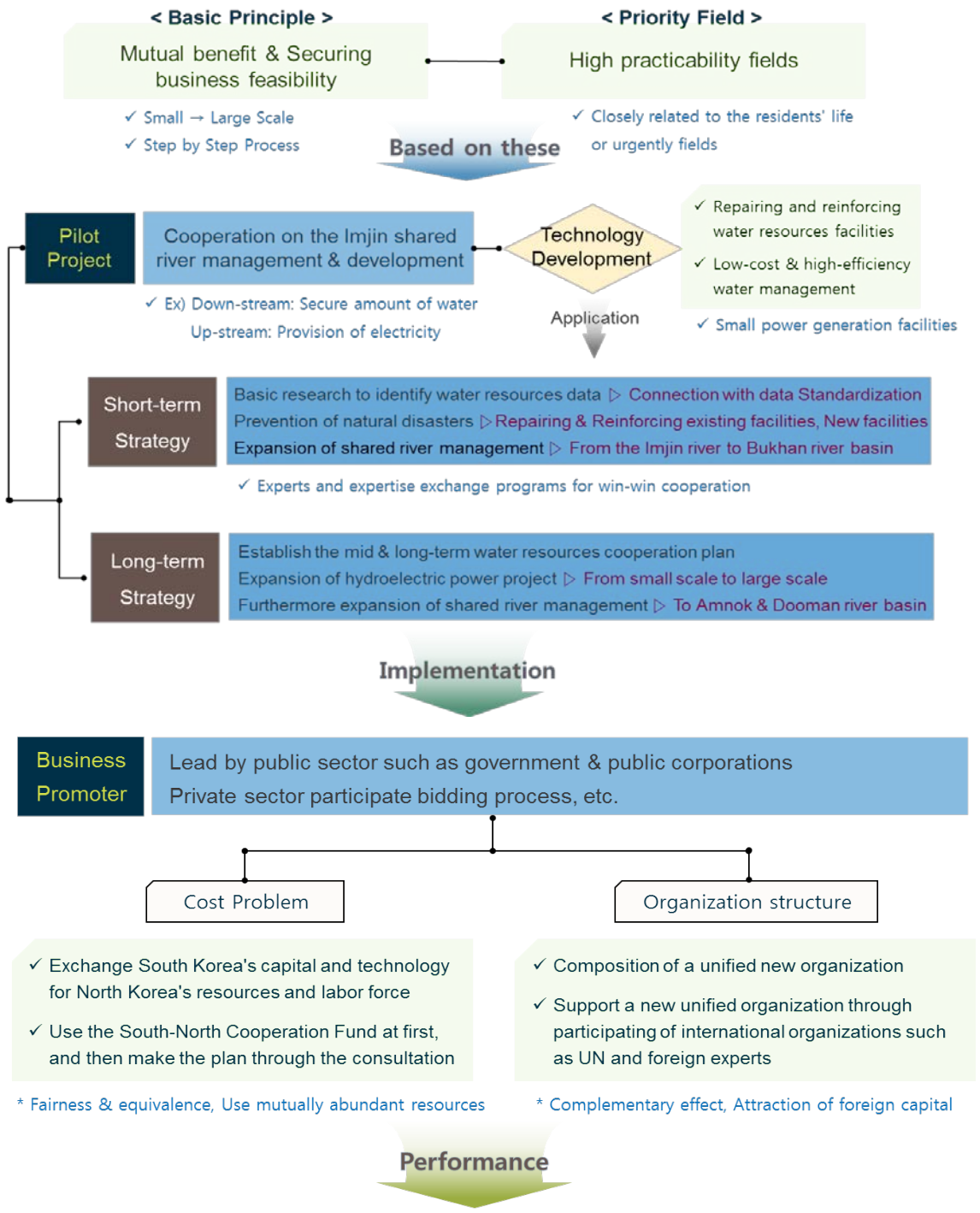
Second, in the short-term, the collaborative project have to carry out a basic research to identify the status of water resources which should be linked to the standardization of data. In addition, in order to prevent natural disasters such as floods and droughts, the existing water resource facilities should be repaired and reinforced. At the same time, new water resources facilities should be constructed and expanded as needed. In the case of cooperation of a shared river, it should be implemented the Imjin river basin first as a pilot project and then be expanded it to the Bukhan river basin. Moreover, experts and expertise exchange programs for win-win cooperation between the two countries should be conducted continuously. In the long-term perspectives, on the other hand, it is necessary to establish the middle & long-term water resources cooperation plan and also need to expand the hydroelectric power project. Especially, shared river project might be a good case, if the project expand into the Amnok and Dooman which are the international shared river basins.

Third, the public sector which includes both government and public corporations should initiate the cooperation. Meanwhile, the private sector would be able to participate through the bidding process etc. in consideration of the specificity and limitations of inter-Korean relations. Regarding the costs that could be a major issue, we should seek to utilize the way to exchange South Korea's capital and technology for North Korea's resources and labor force to promote a fair and equal cooperation environment. However, it might be needed some time such as a period of consultation. Therefore, it could be possible to use the South-North Cooperation Fund initially and then make the further plan through the

consultation between the two countries. Eventually, it needs to pursue common benefits by utilizing mutually abundant resources rather than one-sided cost burden. In the case of organizational structure, it is a good idea to compose a new and unified organization for cooperation between the two countries. Meanwhile, international organizations such as the United Nations and foreign experts should be able to support a new and unified organization. Eventually, through this cooperation model, South Korea would be able to solve the problem of shared river issues in the border area, establish a foundation for unification, and obtain the opportunities to be linked and expanded to other projects. This would also potentially expand South Korea's economy. On the other hand, North Korea would be able to acquire the foundation for economic growth and possibly improve the lives of the residents suffering from waterborne diseases and health effects of poor water quality. In addition, this cooperation could also push the modernization of water resources facilities and prevention from damages caused by natural disasters.

Finally, this research has limitations in the following aspects. North Korea's issues are highly variable depending on the domestic and foreign political and security situation. Besides, it has a matter of public data acquisition and reliability of acquired data. It is difficult to collect even the most basic data like the status of water resources facilities in North Korea. Eventually, this issue about public data acquisition and reliability is a matter of discussion and resolution in the early stages of cooperation as mentioned above. Second, it is an issue about security. The reports and documents of the North Korean water resources were limited to approach due to the security problems. Third, it is about a detailed sector. There would be limitations in providing detailed and actual plans like in the aspects of promotion, alternatives and economic feasibility for each project.

Figure 9　Policy recommendation.



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Appendix

Questionnaire on the cooperative measures of water resources field between South Korea and North Korea

Hello? Thank you for taking your precious time.

This investigation is a survey conducted to collect various opinions on the "Cooperative measures of water resources field between South and North Korea". Your response will not be used for any purpose other than for research purposes, and your personal content will not be evaluated or configured separately. In addition, since there is no correct answer, I would like to ask for your thoughts and experiences.

* Water Resources Field: General water-related fields such as water resources, water supply, water quality, and power generation, etc.

We will do our best so that your response will be presented as a more diverse plan for cooperation in the water resources field between South and North Korea.

Ⅰ. Evaluation phase

1. Necessity of cooperation

1.1 Do you think that it is necessary the cooperation between South and North Korea in the water resources field?

① Completely true ② Very true ③ Moderately true ④ Not true ⑤ Absolutely not true

1.2 Do you think that the plan for cooperation between South and North Korea should be suggested as a government policy, such as “*Long-term comprehensive plan for water resources” and “*Long-term planning for dam construction”?

* A national plan established every five years

① Completely true ② Very true ③ Moderately true ④ Not true ⑤ Absolutely not true

2. The condition of water resources in North Korea

2.1 Compared with South Korea, what is the level of water resources management in North Korea?

① 1950~1960s Level: Lack of facilities and systematization, poor facilities and technology

② 1970~1980s Level: Lack of systemization such as operation, management and technology

③ 1980-1990s Level: Water resources facilities and systemization are overall organized

④ 1990-2000s Level: Water resources facilities and systemization are highly organized

⑤ 2000 ~ Present Level: Very systematic water management level similar to South Korea

(Different opinion: _____)

2.2 If North Korea's water resources field is vulnerable, what is the biggest reason?

① Insufficient financial resources and investment by the North Korean government

② Lack of water management expertise and technology in North Korea

③ Problem of water management organization in North Korea

④ Problem of water management system in North Korea

⑤ Absence of water resources plan and policy by the North Korean government

(Different opinion: _____)

Ⅱ. Implementation phase

1. Cooperation Field

1.1 What do you think about the most urgent field for cooperation between two countries?

① Cooperation on prevention of natural disaster

② Cooperation on water supply for preventing the draught

③ Cooperation on hydropower project to solve power problem

④ Cooperation on *shared river's operation and management * A river that crosses the border

⑤ Mutual cooperation on adaptation of climate change

(Different opinion: _____)

1.2 What do you think about the top priority for cooperation between two countries?

① A field which is closely related to the residents' life

② A high practicability fields in terms of cooperation

③ A field of high project feasibility

④ A field that is the basis of economic growth in North and South Korea

⑤ A field that can contribute to the unification of North and South Korea

(Different opinion: _____)

1.3 What do you think about the most feasible area for cooperation between two countries?

① A field which is related to the shared river's operation and management

② Water supply to solve food problems

③ Exchanging of mutual technologies for efficient water resource management

④ Water quality management which is related to residents' life such as water-borne diseases

⑤ Reconstruction of water resource facilities for preventing of natural disasters

(Different opinion: _____)

1.4 Which area should be promoted as a pilot project for cooperation between two countries?

① Gaeseong ② Pyongyang ③ Imjin river ④ Bukhan river ⑤ Amnok river ⑥Dooman river

(Different opinion: _____)

2. Cooperation Principles and Business Fields

2.1 What was the most appropriate model of cooperation between two countries in the past?

① Mt. Kumgang Tourism

② Gaeseong Industrial Complex

③ Simple cooperation of shared river such as the Imjin River

④ Multinational development projects such as the Najin-Sonbong special economic zone

⑤ There was no suitable way to be exemplary

(Different opinion: _____)

2.2 Which was the suitable case for cooperation in foreign countries?

① Cooperation of water quality in Five Great Lakes between the US and Canada

② Cooperation of water quality in Rhine river among the western European countries

③ Cooperation of water quality in Elbe river between East and West Germany

④ Cooperation of river use in Mekong river among Southeast Asian countries

⑤ There was no suitable way to be exemplary

(Different opinion: _____)

2.3 Which principles should we follow for cooperation of water resources field between two countries?

① Basics for unification of South and North Korea

② Securing the business feasibility of mutually beneficial projects

③ Need to cooperate in urgent fields such as residents' life issues

④ Promote in a direction to help the economic growth of South and North Korea

⑤ Approach based on North Korea's acceptability

(Different opinion: _____)

2.4 Which fields should we promote in the short-term for cooperation between two countries? (3 choices)

① Water supply project for increasing the food production

② A Project for preventing natural disaster ③ Hydropower project to solve power problem

④ Water quality improvement project which is related to water-borne disease

⑤ Research project for identifying the water resources condition

⑥ Establishment of the water resources cooperation plan in the mid & long-term perspectives

⑦ A Project of cooperation on shared river's operation and management

⑧ Exchanging of mutual technology and expert for efficient water resource management

(Different opinion: _____)

2.5 Which fields should we promote in the long-term for cooperation between two countries? (3 choices)

① Water supply project for increasing the food production

② A Project for preventing natural disaster ③ Hydropower project to solve power problem

④ Water quality improvement project which is related to water-borne disease

⑤ Research project for identifying the water resources condition

⑥ Establishment of the water resources cooperation plan in the mid & long-term perspectives

⑦ A Project of cooperation on shared river's operation and management

⑧ Exchanging of mutual technology and expert for efficient water resource management

(Different opinion: _____)

2.6 In the middle of the public and private sector, who should be the promoter of the project in order to cooperate in the water resources field between two countries?

① Lead by the Public sector such as government and public corporations, and the private sector participates through the bidding process, etc.

② The government and public corporations arbitrates the cooperation, and the domestic private sector lead to the project

③ The government and public corporations arbitrates the cooperation, and domestic and foreign private sector lead to the project

④ Consideration of limited resources, a method of joint investment & operation between public and private sector

⑤ Promote in various ways as needed

(Different opinion: _____)

3. Cooperation Costs and Benefits

3.1 Which method is more desirable to solve the cost issue for cooperation in water resources field between two countries? (2 choices)

① A humanitarian assistance considering the poor North Korean situation

② Exchanging capital(Technology) of South Korea with natural resources(Labor force) of North Korea

③ Using the South-North Cooperation Fund at first and then make the plan through the consultation between two countries

④ Attraction of foreign capital investment even if it takes time. For example, multi-national development projects such as the Najin-Sonbong special economic zone

⑤ Based on international community support such as UN

(Different opinion: _____)

3.2 In the case of North Korea, what is the biggest benefits through the cooperation in the water resources field? (2 choices)

① Economic growth of North Korea

② Solving current issues which are closely related to residents' life

③ Prevention of natural disaster damage

④ Improving technology and efficiency in North Korea's water resources field

⑤ Solving the problem of the serious power shortages

⑥ Stability of internal system and organization

(Different opinion: _____)

3.3 In the case of South Korea, what is the biggest benefits through the cooperation in the water resources field? (2 choices)

① Basics for unification of South and North Korea

② Solving current issues in the border area, such as the shared river's issues

③ Improvement of economic efficiency by utilizing North Korea's cheap labor

④ Effects of reform and openness in the North Korean system

⑤ Attraction of the foreign capital investment through cooperation

⑥ Expansion of other businesses through cooperation of water resources field

(Different opinion: _____)

Ⅲ. Monitoring phase

1. Technical field

1.1 Which technologies do we have to develop more for cooperation in the water resource field from now? (2 choices)

① A technology for repairing and reinforcing of existing facilities such as aging dams

② Research and management technologies that are based on the 4th industrial revolution such as a *LiDAR and drone * Use the laser to visualize the surroundings

③ Low-cost & high-efficiency technologies for improvement of the water quality

④ Small-scale power generation technologies to solve the problems of the power shortage

⑤ Hydrological analysis system for predicting weather and hydrology

⑥ A technology of water facility connection in terms of operation and management

(Different opinion: _____)

2. Organization field

2.1 For cooperation in the water resources field, how do we establish the organization to deal with overall shareholders, procedures, planning processes, implementation and analysis of results? (2 choices)

① Make a uniform new organization such as a water resources cooperation committee

② Operation of respective organizations each country, but composition of new organizations according to their needs

③ Operating as a separate and unique organization by procedures (Plan-Execution-Analysis)

④ Two-way configuration of public and private sector organizations

⑤ Multilateral organization for participation by various experts, including the UN

(Different opinion: _____)

Ⅳ. The others

1. Basic question

1.1 What is your gender?

① Male ② Female

1.2 What is your age?

① 20s ② 30s ③ 40s ④ 50s ⑤ 60s and more

1.3 What is your specialty?

① Administration area (Economy)

② Planning area (Strategy)

③ Designing area (Policy)

④ Business area (Development)

⑤ Operation and management area (Management)

Thank you very much for responding to the survey.